

PRELIMINARY RESULTS FROM THE JOINT RUSSIAN AND U.S. FIELD TEST: MEASUREMENT OF SENSORIMOTOR AND CARDIOVASCULAR RESPONSES IMMEDIATELY FOLLOWING LANDING OF THE SOYUZ SPACECRAFT

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Ongoing collaborative research efforts between NASA's Neuroscience and Cardiovascular Laboratories, and the Institute of Biomedical Problems' (IBMP) Sensory-Motor and Countermeasures Laboratories have been measuring functional sensorimotor, cardiovascular and strength responses following bed rest, dry immersion, short duration (Space Shuttle) and long duration (Mir and International Space Station) space flights. While the unloading paradigms associated with dry immersion and bed rest have do serve as acceptable flight analogs, testing of crew responses following the long duration flights does not begin until a minimum of 24 hours after landing. As a result it is not possible to estimate the nonlinear trend of the early (<24 hr) recovery process nor is it possible to accurately assess the full impact of the decrements associated with long duration flight. To overcome these limitations both the Russian and U.S. sides have implemented testing at the time of landing and before the flight crews have left the landing site. By joint agreement this research effort has been identified as the functional *Field Test* (FT). For practical reasons the FT has been divided into two phases: the full FT and a preliminary pilot version (PFT) of the FT that is reduced in both length and scope.

The primary goal of this research is to determine functional abilities in long duration space flight crews beginning as soon after landing as possible (< 2 hr) with one to three immediate follow-up measurements on the day of landing. This goal has both sensorimotor and cardiovascular elements including an evaluation of NASA's new anti-orthostatic compression garment as compared with the Russian Kentavr garment. Functional sensorimotor measurements will include, but are not limited to, assessment of hand/eye coordination, ability to egress from a seated position, walk normally without falling, measurement of dynamic visual acuity, ability to discriminate different forces generated with both the hands and legs, recovery from a fall, a coordinated walk involving tandem heel-to-toe placement and determination of postural ataxia while standing. The cardiovascular portion of the investigation includes blood pressure and heart rate measurements during a timed stand test in conjunction with postural ataxia testing. In addition to the immediate post-landing collection of data for the full FT, postflight data will be acquired at a minimum of one to three more other times within the 24 hr following landing and continue until functional sensorimotor and cardiovascular responses have returned to preflight normative values.

The PFT represents a single trial run comprised of jointly agreed tests from the full FT and relies heavily on IBMP's Sensory-Motor and Countermeasures Laboratories for content, and implementation. The PFT is currently scheduled for the September 2013 landing of the Soyuz spacecraft (34S). Testing will include: (1) a sit-to-stand test, (2) recovery from a fall where the crewmember begins in the prone position on the ground and then stands for 3 min while cardiovascular stability is determined and postural ataxia data are acquired, and (3) a tandem heel-to-toe walk to determine changes in the central locomotor program. Video, cardiovascular parameters (heart rate and blood pressure), data from body-worn inertial sensors and severity of postflight motion sickness will be available for analysis. It is our intent to present, at this celebratory symposium, a summary of these data obtained from two crewmembers.

In summary, the level of functional deficit is expected to be most profound during the acquisition of gravity loads immediately after landing when the demands for crew intervention in response to emergency operations will be greatest. Clearly measureable performance parameters such as ability to perform a seat egress, recover from a fall or the ability to see clearly when walking, and related physiological data (orthostatic responses) are required to provide an evidence base for characterizing programmatic risks and the degree of variability among crewmembers. Overall, these early functional and related physiological measurements will allow estimation of nonlinear sensorimotor and cardiovascular recovery trends to an accuracy that has not been previously captured in over 50 years of space flight.